Regional Supervisor,
Branch of Wildlife Refuges

January 28, 1965

EH-R Tewaukon
water mgmt. plan

Regional Engineer,
Minneapolis, Minnesota

Tewaukon NWR, North Dakota - 1965 Proposed Annual Water Program

We have reviewed the subject program and concur in the proposed plan of operation.

Although precipitation was above normal in calendar year 1964, the runoff experienced at Rutland and Cayuga during the year was less than that in 1963. (Precipitation in 1963 was 2.12" below normal.)

Stoltman 1-28-65
Dodin 1-28-65
Stevenson 1-28-65
Richey 1-28-65
Jensen 1-28

We would like the refuge manager to compute and continue to record the outflow from Lake Tewaukon using the observed water elevations at the structure. The Cayuga flow records have been used as an outflow comparison in the past but we must look to the future and attempt to obtain the best estimates of outflow that we can. The way to do this is to keep good records of water levels and gate openings, if any, at the Tewaukon structure. (After the new Tewaukon structure is in operation the procedure described in our May 18, 1964, memorandum "Monthly Gauge Readings" will be quite useful to the manager in figuring how much flow to release to maintain a desired level on Lake Tewaukon.)

As water appropriations continue to increase on the Wild Rice River the need for complete and more detailed flow data will increase correspondingly. State approval of the supplemental refuge water filings submitted by our Bureau and the proposed construction of all Tewaukon Master Development Plan features are all dependent on a sufficient water supply and on records which support our contention that there is a sufficient water supply.

JRN 1-28

We might add that the Cayuga gauging station has a drainage area of 955 square miles compared with a drainage area of only 661 square miles above the Tewaukon outlet structure. (Shortfoot Creek which has a drainage area of 123 square miles makes up a major portion of this difference.) Runoff from the area below Lake Tewaukon can contribute a fair share of the run-off at the Cayuga gauge.

Following is a tabulation of a few Tewaukon computed outflows compared with the Cayuga USGS rated flow:

Date	Tewaukon computed outflow (cfs)	Cayuga USGS flow (cfs)
4/9	57	16
4/20	62.5	76
4/27	79	147*
5/18	21.5	19
5/31	1.92	3.5

Date	Tewaukon computed outflow (cfs)	Cayuga USGS flow (cfs)
6/8	6	3.1
6/30	19.5	12
7/6	31	26
7/20	7.7	7.2
7/27	2.6	2.5
8/3	0.6	1.1

* 1964 maximum daily discharge

We suggest that the manager check the above Tewaukon computed outflow column with his computed flow data and adjust his records where necessary.

From the table it is noted that the computed Tewaukon May-July flow was greater than the Cayuga flow. This would be true if there were downstream channel losses or depletions. However, our computed flows might be high, as a result of using too high a discharge coefficient (3.33) or possibly because of debris blocking a portion of the 32 foot Tewaukon spillway resulting in a reduced effective crest length.

Again, with reference to our memorandum of May 18, 1964, we would like to remind the refuge manager to record the water elevation downstream from the Tewaukon structure whenever it "backs up" over the spillway during a flood. This downstream level is needed to compute the discharge under "submerged flow" conditions.

Our compliments to the manager on his good 1964 refuge pool water use records and on the data he presented for the new pools 5 through 9.

John D. Umberger

2 extra cc attd.

CWStephan:rj 1/28/65

AN[illegible]L WATER PROGRAM - TEWAUKON REP[illegible]E

I. 1964 Water Use Data.

IMPOUNDMENT DATA

Lake Tewaukon for Calendar Year 1964
(spillway elevation 1147)

Month	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	1147.14 (ice)	1,090	6,960
Feb.	1147.08 (ice)*	1,085	6,880
Mar.	1147.04	1,082	6,840
Apr.	1147.50	1,125	7,410
May	1147.34	1,110	7,210
June	1147.17	1,093	6,985
July	1147.26	1,101	7,090
Aug.	1146.92	1,078	6,790
Sept.	1146.88	1,075	6,700
Oct.	1146.66	1,058	6,580
Nov.	1146.59	1,053	6,500
Dec.	1146.40	1,038	6,100

Cutler Marsh for Calendar Year 1964
(spillway elevation 1149)

Month	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	1149.00 *	187	443
Feb.	1148.88 (ice)*	183	429
Mar.	1148.99	193	437
Apr.	1149.72	235	576
May	1149.55	229	520
June	1149.40	220	490
July	1149.54	228	517
Aug.	1149.04	196	441
Sept.	1149.12	202	450
Oct.	1148.86	181	426
Nov.	1148.73	169	420
Dec.	1148.56	150	375

White Lake for Calendar Year 1964 (1)
(spillway elevation 1149)

Month	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	1149.22 *	259	527
Feb.	1149.22 *	259	527
Mar.	1148.97 *	235	501
Apr.	1149.79	344	599
May	1149.61	321	579
June	1149.30	268	536
July	1149.35	273	541
Aug.	1149.06	243	511
Sept.	1149.01	239	506
Oct.	1148.78	223	482
Nov.	1148.56	208	459
Dec.	1148.50 (ice)	204	453

* Estimated
(1) Presently controlled by Cutler Marsh structure

Clouds Lake for Calendar Year 1964
(spillway elevation 1177)+

Month	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	1176.72 (ice)*	128	550
Feb.	1176.82 (ice)*	128	550
Mar.	1177.05 *	131	582
Apr.	1177.18	132	601
May	1177.42	134	634
June	1177.05	130	582
July	1177.11	131	591
Aug.	1176.79	128	547
Sept.	1176.58	125	520
Oct.	1176.32	121	505
Nov.	1175.00	109	375
Dec.	1175.00	109	375

Sprague Lake for Calendar Year 1964

Month	Elevation (2) (feet)	Area (acres)	Capacity (acre-feet)
Jan.	1208.74 *	167	595
Feb.	1208.74 *	167	595
Mar.	1209.14 *	171	660
Apr.	1209.44	174	710
May	1209.24	172	675
June	1209.05	170	640
July	1208.86	168	610
Aug.	1208.77	167	597
Sept.	1208.69	166	585
Oct.	1208.48	164	550
Nov.	1208.36	163	530
Dec.	1208.20	161	505

Mann Lake for Calendar Year 1964

Month	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	1209.10 *	48	208
Feb.	1209.10 *	48	208
Mar.	1210.00 *	52	250
Apr.	1210.50	55	300
May	1209.64	51	232
June	1209.46	50	222
July	1209.59	51	230
Aug.	1208.83	47	193
Sept.	1208.85	47	195
Oct.	1208.56	46	182
Nov.	1208.39	45	174
Dec.	1208.40	45	173

+ Spillway elevation change to 1180 on September 1, 1964 (See page 7 proposal also)
* Estimated
(2) Corrected to true elevation (-4.36 from gauge reading's)

Pool #5 for Calendar Year 1964 (1)

Month	Average Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.-Aug.	1156.00 *	2	4
Sept.	1163.00 *	16	70
Oct.	1162.50 *	13	52
Nov.	1162.50 *	13	52
Dec.	1162.50 (ice)*	13	52

Pool #6 for Calendar Year 1964 (2)

Month	Average Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.-Aug.	Not constructed		
Sept	1166.89 *	7	24
Oct.	1166.39 *	6	18
Nov.	1165.00 *	5	10
Dec.	1164.54 (ice)*	5	8

Pool #7 for Calendar Year 1964 (3)

Month	Average Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.-Sept.	Not constructed		
Oct.	1174.00 *	25	40
Nov.	1174.00 *	25	40
Dec.	1173.80 (ice)*	23	38

Pool #9 for Calendar Year 1964 (4)

Month	Average Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.-Sept.	dry	-	-
Oct.	1167.00 *	10	25
Nov.	1167.00 *	10	25
Dec.	1167.00 *	10	25

(1) Filled by release from Clouds Lake 9/16 - 9/19 ✓
(2) Filled by release from Clouds Lake 9/19 - 9/22 ✓
(3) Filled by release from Clouds Lake 9/30 - 10/3 ✓
(4) Filled by release from Clouds Lake 10/21 - 10/29 ✓

Summary of 1964 Water Program

General.

Water conditions remained much the same as the past two years with all major pools and lakes remaining at or near spillway levels. Precipitation for the year was 1.51 inches above normal with June and August rainfall considerable above average. An unseasonably dry fall resulted in the water levels at the end of the year being at the lowest level since 1961 but all lakes and pools are still in good shape as far as water levels are concerned.

The Wild Rice River began flowing in April from snow melt runoff and quickly filled all the lakes connected to it. Water flowed out of Lake Tewaukon during April, but by the end of May it had ceased. Heavy June rains again started it flowing and outflow continued until early July. Since that time no flow out of Lake Tewaukon has occurred.

Runoff from the Wild Rice River and small tributary streams resulted in Lake Tewaukon reaching its highest level in April. The water level receded during the remainder of the year with the lowest reading made in December. The outlet structure remainded functional throughout the year, helped, undoubtedly, by the reduced flow passing over it. The annual algae bloom began in July and continued until nearly freeze-up. On a few occassions the wind would pile enough algae so that it would produce a "stink".

Culters Marsh was filled to spillway level shortly after the Wild Rice River began flowing in the spring. The highest gauge reading was made in May. Heavy June rains produced a second period of high water in late June and early July. Since that time the water level has steadily receded.

White Lake, which is connected to Culters Marsh, fluctuated much as did the marsh. The highest average monthly level was reached in April. Another period of high water occurred in July but did not equal the April peak. Since July the water level had receded.

Clouds Lake, as a result of planned manipulation, showed the greatest fluctuation of any of the major bodies of water on the refuge. The peak water level was recorded in May and with the exception of minor irregularity receded until September. In late August and September two culverts were installed to permit release of water from Clouds Lake. A twelve inch culvert with a slide gate was placed from Clouds Lake to pool #9, at an elevation of approxmatly 1174.00. A twenty four inch culvert with slide gate was placed on the east side at an elevation of 1174.00 through the rock spillway. The spillway was, as a result, was raised to an estimated elevation of 1180.00. In September and October water was released from Clouds Lake to pools 5, 6, 7 and 9 and the water level dropped rapidly to 1175.00 where it remained at freeze-up.

Sprague Lake fluctuated much as did the other refuge lakes reaching a peak in April and receding throughout the remainder of the year.

Mann Lake fluctuated rather widely during the year. The primary reasons for its varying water level is thought to be it's direct connection with the Wild Rice River and it small size. The largest drop, almost a foot, was recorded from April to May and since that time it has receded less rapidly.

The potholes, which play a major role in the production of ducks, fluctuated widely but the overall effect was a continued deterioration of their condition. April runoff filled many of the potholes but by the end of May only 12.5% retained water. Heavy June rains refilled some but it was apparently too late to be used by breeding ducks. The potholes continued to dry up during the summer and fall, by freeze-up approximately 3% contained water.

Several management alternatives were made possible with the placing of culverts with slide gates into Clouds Lake. To take advantage of these alternatives pools #6 and #7 were constructed on the drainage flowing east from Clouds Lake. A twenty-four inch concrete culvert with gate was placed in the dike on pool #6 so that water could be easily passed into pool #5. Pools #5 and #6 were filled in September and #7 filled in October. Pool #9 located north of Clouds Lake was flooded in October.

Food Supplies

Production of submergent aquatic vegetation was less than a year ago. Of the major water areas, Culters Marsh was the only one observed with significant production of submerents. Bladderwort predominanted with a few scathered beds of sago. Culters Marsh also had good production of star duckweed and lesser duckweed.

Some small beds of sago pondweed were noted in Clouds Lake during July and August but had disappeared by the time migrant waterfowl arrived. Food produced in the potholes, which in years of good water, have provided much food for ducks was only of minor importance this year. With many potholes dry most of the food which was produced was unavaible to waterfowl.

Waterfowl Use

Lake Tewaukon was the first of the refuge lakes to begin to break-up in the spring and as a result received heavy spring use by ducks, geese and swans. Summer use was very minor but during the fall was used by geese, ducks, (mostly mallards and scaup) and swans. It is the primary "diver" lake during spring and fall migration.

Culters Marsh, with its favorable interspersion of emergent vegetation and water, received the heaviest waterfowl use of all refuge lakes. During the spring and fall migration it hosts most of the mallards that pass through the refuge.

White Lake received only minor waterfowl use. Clouds Lake was used heavily by swans during the spring and received good use by ducks and geese during the fall. Sprague Lake received fair use during the spring and fall but Mann Lake, at no time, received much waterfowl use.

The fall flooded impoundments, with the exception of pool #5 received heavy migrant use by ducks and geese. Pool #6 and #7 received at least 75% of the resting and watering use by geese. The attraction of the new impoundment is attributed to their barren shorelines, shallow water resulting in mud flat condition and close proximity to the feeding areas. Pool #9 received good use by mallards after it had been flooded.

Vegetation Control

No specific water management program was under taken this year for control of aquatic vegetation. Cattails sprayed with Amitrol "T" in 1963 were checked for duck use and cattail kill several times during the summer. Production of star duckweed and lesser duckweed was good in the recently sprayed strips and attracted mostly mallards and wood ducks. Cattail kill was nearly complete and Culters Marsh is now broken up into alternate strips of open water and emergent vegetation.

The plowing of strips through shallow, dry marshes in the fall of 1963 appeared to provide attraction areas for breeding pairs, although evaluation is difficult. With runoff the potholes held some water and the plowed strips broke up the vegetation and open water was present. Beside providing some open water the turned soil provided an excellent loafing area and the dead furrow retained water somewhat longer than would normally have been the case. This plowing shows some promise to make the shallow type I and III potholes more attractive to breeding pairs but a great deal more evaluation is necessary.

Water Management - 1965

Lake Tewaukon, Sprague and Mann Lakes will be held as high as existing conditions permit. Flow from the Wild Rice River, runoff and rainfall will be the primary sources of water for Tewaukon and Mann Lakes.

Sprague Lake will receive additional water from the channel impoundment, completed this summer, which will bring water to the lake from a watershed dam located to the south. Construction of the new control structure on Lake Tewaukon should be completed in 1965 but will not effect water management this year. It is douftful that there will be enough water to permit flooding of the additional area after construction is completed.

It is proposed to draw down Culters Marsh to 1147.00 during mid summer which will also effect somewhat of a draw down on White Lake. The draw down will permit construction or improvement of the structure on Culters Marsh. At the lower water level it may be possible to get a winter kill of fish and permit submergent aquatic vegetation to return. It will also expose mud flats which should be attracted to waterfowl during the fall migration and permit the removal of stumps, dead trees etc. along the south and west shores of the marsh. This will make it more attractive as a resting and watering area to waterfowl when the marsh is reflooded. It is also proposed to spray or mow the cattails along the south and west shore of the lake to thin them out.

Clouds Lake will be held as high as conditions permit until late summer with periodic releases to pools #5, #6 and #9 to maintain water levels. A late summer draw down will be effected by passing water to the pools #7, #6, #5 and into the Wild Rice River. Elevation after draw down will be approxmately 1174.00. Rotenone will be used in the fall to effect a complete kill of fish in Clouds Lake. A rock spillway will be constructed with overflow elevation of 1179.00 on the east end of the lake.

Pool #5 will be drained as soon as working conditions permit in the spring. A twenty-four inch culvert with a control structure will be installed and the pool will be reflooded. It will remain at maxiumum elevation for the remainder of the year.

Pool #6 will be held at maxiumum level throughout the year.

Pool #7 will be drained as soon as the construction is completed on #5 with the water used to reflood #5. We will attempt to plant millet in pool #7 and it will be reflooded in the fall. If equipment becomes available the temporary plug which now forms pool #7 will be moved downstream so as to flood a larger area.

Pool #9 will be held at maxiumum level throughout the year.

The marsh located in the NE¼ Sec. 34, T. 130 N., R. 54 W., will be planted to millet and if water is available it will be flooded in the fall.

A small plug may be placed below pool #5, on the Clouds Lake drainage, to flood standing grain with water released from #5.

As facilities are constructed which permit manipulation of water levels the evaluation of the planned manipulation should be initiated. Vegetative transects should be set up on all pools where fluctuation or management techniques are attempted such as eliminating carp etc. Some what more detailed observation whould be made on waterfowl use of the various pools at various elevation to learn what conditions produce maximum breeding pairs, brood and migrant use.

Tennessee

Possible Additional comments

1) Proposed to lower elevation of Spillway from 1180 to 1179.0 - page 7

2) Const. seat of learning - cost of new structure on Cutler Ranch? page 7

3) Proposed high levels for 1965 for Tennessee page 6

4) ~~Comment on good records for following years 57 to 7, and 9~~